100071

A Preliminary Assessment

of

Standard Chlorine

EPA No. DE-53

Emergency and Remedial Response Information System

Grant No. X-003282-01-0

December, 1983

Presented to: Mr. E. Skernolis, Acting Chief, Site Investigation & Support Section, U.S. EPA, Region III

Prepared by: Delaware Department of Natural Resources and Environmental Control, Solid Waste Branch

Thomas Gainer, ERRIS Investigator

Robert Pickert, ERRIS Coordinator

Table of Contents

I. Introduction

Inquiry Source

Notification of spill (9/16/81).

General Summary

A Preliminary Assessment (PA) and Site Inspection (SI) of Standard Chlorine (DE-53) was prepared by the Delaware Department of Natural Resources and Environmental Control (DNREC) on September 9, 1982. Together with reports prepared by Roy F. Weston, Inc., the Standard Chlorine site has been thoroughly investigated, so a site visit is not necessary at this time. This Preliminary Assessment will compile past and on-going work done on the site.

On September 19, 1981 there was a tank car spill of approximately 5,000 gallons of reagent grade (99.9% pure) monochlorobenzene (MCB) at Standard Chlorine Plant in Delaware City, Delaware. The spill runoff traveled along drainage paths leading to Red Lion Creek, and some of the MCB entered the creek. However, most of the MCB entered the ground at the site.

Soil and groundwater tests showed that MCB contamination had occurred.[15] A 9/21/81 soil sample at the spill location showed MCB concentrations of 12,800 to 8800 ppm to a depth of 3 feet.[1] Shortly after the spill, soil from the drainage ditch was excavated and stored in a diked, concrete pad. Approximately 40 gpm (from the spill date to the present, with occasional down time) of surface and subsurface (from the drainage ditch and groundwater) water was removed and treated at an on-site waste treatment facility.[2] Periodic testing at the site by the DNREC shows that the groundwater is chaulky white and currently contains 63 ppm MCB.[4]

Groundwater MCB levels were 120 ppm in June 1983 and probably would have been in the percent range (for MCB) if insoluable liquid was homogenized before the sample was analyzed (reported concentrations are from supernatent portion).[4] Stream samples of Red Lion Creek[3] indicate that most of the MC is tied up in the bottom.[16] White perch from Red Lion Creek had a MCB concen-

tration of 0.07 ppb.[18]. In addition to MCB, groundwater sampling also showed contamination by benzene, ortho and paradichlorobenzene, and 1, 2, 4 - trichlorobenzene, indicating that previous leaks and spills of products had occured at the Standard Chlorine site.

Standard Chlorine and Roy F. Weston, Inc. are working on remedial activities to recover and treat the contaminants in the groundwater at the site, and these processes (including air stripping with exhaust gas consumed in an existing boiler) should be operational in the later half of 1984.

Recommendations

Although the contamination of the groundwater at the Standard Chlorine site with benzene and chlorinated benzenes is serious, the DNREC feels that the previous investigations by the DNREC and Roy F. Weston, Inc. (for Standard Chlorine) are thorough. Standard Chlorine has assumed responsibility for abatement of the groundwater contamination. The DNREC will continue to monitor Standard Chlorine's remedial activities to assure that the groundwater is decontaminated to the extent possible. Periodic groundwater sampling should be continued (and is part of Standard Chlorine's contaminant abatement program which was accepted by DNREC) to better determine the horizontal and vertical extent of contamination as well as up and downstream sediment sampling of Red Lion Creek to determine if contaminated groundwater is entering the stream.

II. Site History

Permits

Standard Chlorine has several air permits, NPDES permits, and a RCRA generator permit.[17]

Site Owner

The property is owned by Standard Chlorine, Inc.

Local Residents

None were contacted.

Media Coverage

The following newspaper articles appeared in the Wilmington News Journal:

11/15/83 EPA checked the Standard Chlorine site for dioxin and none was found.

3/10/82 Standard Chlorine is one of 312 plants in 37 states cited by The National Clean Air Coalition (Washington, D.C.) for toxic emissions.

1/3/82 Suit filed by the DNREC against Standard Chlorine for wastewater effluent violations between August 1977 - January 1980 for $23,000 and instruction to build additional wastewater treatment facilities.

Other Background

An EPA biodegradability study concluded that stability to biodegradation increases with more highly chlorinated phenols.[5] Another report stated that all substituted benzenes biodegrade to some extent, and that MCB is reasonably mobile while 1, 2, 4-trichlorobenzene is significantly retained by the soil.[6] A 10/30/73 groundwater analysis from a Diamond Shamrock well (east and adjacent to Standard Chlorine) shows contamination with ortho and paradichlorobenzene.[14 & 15] This contamination is probably due to leaks and spills at Standard Chlorine or from its discharge pipe which outfalls to the Delaware River and crosses Diamond Shamrock's property since these substances are used at Standard Chlorine and groundwater may flow towards Diamond Shamrock's wells from the Standard Chlorine site or wastewater pipeline.[20]

Enforcement Status

The DNREC is now monitoring remedial work by Standard Chlorine to recover groundwater contaminated with benzene and chlorinated benzenes as a result of the 9/16/81 spill and other leaks and spills.

III. Environmental Setting

Surface Water

The site is 0.25 miles south of Red Lion Creek and 0.75 miles west of the Delaware River. Stream sampling and bioassays in the Red Lion Creek have detected trace levels of MCB.[3 & 18] Both water bodies are somewhat brackish at this location and are not used as a drinking water supply (Getty Refining & Marketing Co. has a water intake on Red Lion Creek further upstream, near Rt. 13).

Groundwater

The water table in this area is approximately 6 feet below the ground surface.[7] Shallow groundwater appears to flow northeast from the site to the Red Lion Creek.

Geology and Soils

The soil is composed of Matapeake silt loam.[8] The Columbia Formation is 45 feet thick at the site and the Potomac Formation lies below it.[7] It is uncertain if the two aquifers are hydraulically connected,[19] however, the uppermost Potomac sediments encountered in test borings are fine-grained and nearby wells (owned by Getty and Diamond Chemicals) in the Potomac Formation show the aquifer to be confined.[20]

Land Use

The area is mostly industrialized. However, there are farms to the south and west of the site.[10]

Population Distribution

Delaware City lies 2 miles southeast of the site and has 1900 residents. The City of New Castle lies 5 miles northeast of the site and has 4900 residents.[9] See Section II, part IX of the previous DNREC report.

Water Supply

Getty Refining & Marketing Company has 8 industrial water supply wells (which are also used for drinking water in the plant) within 1.5 mi[illegible] of the Standard Chlorine plant. The Getty wells are 350-850 f[illegible] the aquifers of the Potomac Formation), and no benzene or chlorinated benzenes have

been indentified in the water to date.[11] Standard Chlorine's water, including drinking water, is supplied by Wilmington Suburban Water Company (whose source of supply is surface water from another stream drainage basin).[12]

Critical Environments

The drainage path to the west of the plant that flows into Red Lion Creek into which some of the MCB spill flowed includes a tidal wetlands area. The site is also approximately 1500 feet south of the tidal wetlands area along the Red Lion Creek.[13]

IV. Preliminary Assessment Form

EPA

POTE .IAL HAZARDOUS WASTE SITE
IDENTIFICATION AND PRELIMINARY ASSESSMENT

REGION: III

SITE NUMBER (to be assigned by EPA):

NOTE: This form is completed for each potential hazardous waste site to help set priorities for site inspection. The information submitted on this form is based on available records and may be updated on subsequent forms as a result of additional inquiries and on-site inspections.

NERAL INSTRUCTIONS: Complete Sections I and III through X as completely as possible before Section II (*Preliminary Assessment*). File this form in the Regional Hazardous Waste Log File and submit a copy to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force (*EN-335*); 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME: Standard Chlorine of Delaware, Inc.

B. STREET (*or other identifier*): Governor Lea Road, P. O. Box 319

C. CITY: Delaware City

D. STATE: DE

E. ZIP CODE: 19706

F. COUNTY NAME: New Castle

G. OWNER/OPERATOR (*if known*)

1. NAME: Standard Chlorine of Delaware, Inc.

2. TELEPHONE NUMBER: (302) 834-4536

H. TYPE OF OWNERSHIP

[ ] 1. FEDERAL [ ] 2. STATE [ ] 3. COUNTY [ ] 4. MUNICIPAL [X] 5. PRIVATE [ ] 6. UNKNOWN

I. SITE DESCRIPTION

On September 16, 1981, approximately 5,000 gallons of 99.9% pure monochlorobenzene was spilled from a train tank car.

J. HOW IDENTIFIED (*i.e., citizen's complaints, OSHA citations, etc.*)

Notified state of spill when it occurred, also Superfund notification.

K. DATE IDENTIFIED (*mo., day, & yr.*): 9/16/81

L. PRINCIPAL STATE CONTACT

1. NAME: Lisa A. Hamilton/Jay N. Motwani

2. TELEPHONE NUMBER: (302) 736-4781

II. PRELIMINARY ASSESSMENT (*complete this section last*)

A. APPARENT SERIOUSNESS OF PROBLEM

[ ] 1. HIGH [ ] 2. MEDIUM [ ] 3. LOW [ ] 4. NONE [ ] 5. UNKNOWN

[X] MEDIUM HIGH

B. RECOMMENDATION

[ ] 1. NO ACTION NEEDED (*no hazard*)

[ ] 2. IMMEDIATE SITE INSPECTION NEEDED
a. TENTATIVELY SCHEDULED FOR:
b. WILL BE PERFORMED BY:

[X] 3. SITE INSPECTION NEEDED
a. TENTATIVELY SCHEDULED FOR: 1/6/82
b. WILL BE PERFORMED BY: State

[ ] 4. SITE INSPECTION NEEDED (*low priority*)

C. PREPARER INFORMATION

1. NAME: Lisa A. Hamilton

2. TELEPHONE NUMBER: (302) 736-5740

3. DATE (*mo., day, & yr.*): 9/9/82

III. SITE INFORMATION

A. SITE STATUS

[ ] 1. ACTIVE (*Those industrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if intermittently.*)

[ ] 2. INACTIVE (*Those sites which no longer receive wastes.*)

[X] 3. OTHER (*specify*): Not a regular waste disposal site although spills have occurred in the past.
(*Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.*)

B. IS GENERATOR ON SITE?

[ ] 1. NO [X] 2. YES (*specify generator's four-digit SIC Code*): 2812

C. AREA OF SITE (*in acres*): 17.5 (plant property)

D. IF APPARENT SERIOUSNESS OF SITE IS HIGH, SPECIFY:
1. LATITUDE (*deg., min., sec.*): 39° 36'
2. LONGITUDE: 75° 38'

E. ARE THERE BUILDINGS ON SITE?

[ ] 1. NO [X] 2. YES (*specify*): Plant office and manufacturing

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T2070-3 (10-79)

Continue On Reverse

Continued From Front

IV. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

A. TRANSPORTER	B. STORER	C. TREATER	D. DISPOSER
1. RAIL	1. PILE	1. FILTRATION	1. LANDFILL
2. SHIP	2. SURFACE IMPOUNDMENT	2. INCINERATION	2. LANDFARM
3. BARGE	3. DRUMS	3. VOLUME REDUCTION	3. OPEN DUMP
4. TRUCK	4. TANK, ABOVE GROUND	4. RECYCLING/RECOVERY	4. SURFACE IMPOUNDMENT
5. PIPELINE	5. TANK, BELOW GROUND	5. CHEM./PHYS. TREATMENT	5. MIDNIGHT DUMPING
6. OTHER (specify):	6. OTHER (specify):	6. BIOLOGICAL TREATMENT	6. INCINERATION
		7. WASTE OIL REPROCESSING	7. UNDERGROUND INJECTION
		8. SOLVENT RECOVERY	X 8. OTHER (specify): spill
		9. OTHER (specify):	

E. SPECIFY DETAILS OF SITE ACTIVITIES AS NEEDED

V. WASTE RELATED INFORMATION

A. WASTE TYPE

[ ] 1. UNKNOWN [X] 2. LIQUID [ ] 3. SOLID [ ] 4. SLUDGE [ ] 5. GAS

B. WASTE CHARACTERISTICS

[ ] 1. UNKNOWN [ ] 2. CORROSIVE [ ] 3. IGNITABLE [ ] 4. RADIOACTIVE [X] 5. HIGHLY VOLATILE

[X] 6. TOXIC [ ] 7. REACTIVE [ ] 8. INERT [ ] 9. FLAMMABLE

[ ] 10. OTHER (specify):

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

No. Calculated 5,000 gallon spill

2. Estimate the amount(specify unit of measure) of waste by category; mark 'X' to indicate which wastes are present.

a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT	AMOUNT	AMOUNT	AMOUNT 5,000	AMOUNT	AMOUNT
UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE gallon	UNIT OF MEASURE	UNIT OF MEASURE
X (1) PAINT, PIGMENTS	X (1) OILY WASTES	X (1) HALOGENATED SOLVENTS	X (1) ACIDS	X (1) FLYASH	X (1) LABORATORY PHARMACEUT.
(2) METALS SLUDGES	(2) OTHER (specify)	(2) NON-HALOGNTD. SOLVENTS	(2) PICKLING LIQUORS	(2) ASBESTOS	(2) HOSPITAL
(3) POTW		(3) OTHER (specify)	(3) CAUSTICS	(3) MILLING/ MINE TAILINGS	(3) RADIOACTIVE
(4) ALUMINUM SLUDGE			(4) PESTICIDES	(4) FERROUS SMLTG. WASTES	(4) MUNICIPAL
(5) OTHER (specify):			(5) DYES/INKS	(5) NON-FERROUS SMLTG. WASTES	(5) OTHER (specify):
			(6) CYANIDE	(6) OTHER (specify):	
			(7) PHENOLS		
			(8) HALOGENS		
			(9) PCB		
			(10) METALS		
			X (11) OTHER (specify) chlorinated		

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Continued From Page 2

V. WASTE RELATED INFORMATION (continued)

3. LIST SUBSTANCES OF GREATEST CONCERN WHICH MAY BE ON THE SITE [redacted]

Benzene
Monochlorobenzene
Orthodichlorobenzene
Paradichlorobenzene
1,2,4 - Trichlorobenzene

4. ADDITIONAL COMMENTS OR NARRATIVE DESCRIPTION OF SITUATION KNOWN OR REPORTED TO EXIST AT THE SITE.

VI. HAZARD DESCRIPTION

A. TYPE OF HAZARD	B. POTENTIAL HAZARD (mark 'X')	C. ALLEGED INCIDENT (mark 'X')	D. DATE OF INCIDENT (mo., day, yr.)	E. REMARKS
1. NO HAZARD				
2. HUMAN HEALTH	X			
3. NON-WORKER INJURY/EXPOSURE				
4. WORKER INJURY				
5. CONTAMINATION OF WATER SUPPLY	X			Diamond Shamrock wells and Potomac wells in area
6. CONTAMINATION OF FOOD CHAIN				
7. CONTAMINATION OF GROUND WATER		X	9/16/81	Study initiated after spill indicates ground water contamination has occurred
8. CONTAMINATION OF SURFACE WATER		X	9/16/81	Samples from Red Lion Creek indicate contamination has occurred.
9. DAMAGE TO FLORA/FAUNA				
10. FISH KILL				
11. CONTAMINATION OF AIR				
12. NOTICEABLE ODORS		X	9/16/81	Inspection after spill.
13. CONTAMINATION OF SOIL		X	9/16/81	
14. PROPERTY DAMAGE				
15. FIRE OR EXPLOSION				
16. SPILLS/LEAKING CONTAINERS/ RUNOFF/STANDING LIQUIDS		X	9/16/81	
17. SEWER, STORM DRAIN PROBLEMS				
18. [illegible] PROBLEMS				
19. INADEQUATE SECURITY				
20. INCOMPATIBLE WASTES				
21. MIDNIGHT DUMPING				
22. OTHER (specify):				

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VII. PERMIT INFORMATION

A. INDICATE ALL APPLICABLE PERMITS HELD BY THE SITE.

- [X] 1. NPDES PERMIT
- [ ] 2. SPCC PLAN
- [ ] 3. STATE PERMIT (specify):
- [X] 4. AIR PERMITS
- [ ] 5. LOCAL PERMIT
- [ ] 6. RCRA TRANSPORTER
- [ ] 7. RCRA STORER
- [ ] 8. RCRA TREATER
- [ ] 9. RCRA DISPOSER
- [X] 10. OTHER (specify): RCRA generator

B. IN COMPLIANCE?

- [X] 1. YES
- [ ] 2. NO
- [ ] 3. UNKNOWN

4. WITH RESPECT TO (list regulation name & number):

VIII. PAST REGULATORY ACTIONS

- [ ] A. NONE
- [X] B. YES (summarize below)

NPDES discharge out of compliance, settled out of court; now working to improve under a consent agreement.

IX. INSPECTION ACTIVITY (past or on-going)

- [ ] A. NONE
- [X] B. YES (complete items 1,2,3, & 4 below)

1. TYPE OF ACTIVITY	2. DATE OF PAST ACTION (mo., day, & yr.)	3. PERFORMED BY: (EPA/State)	4. DESCRIPTION
Split sampling of monitor wells	1/6/82	State	Split 7 samples.

X. REMEDIAL ACTIVITY (past or on-going)

- [ ] A. NONE
- [X] B. YES (complete items 1, 2, 3, & 4 below)

1. TYPE OF ACTIVITY	2. DATE OF PAST ACTION (mo., day, & yr.)	3. PERFORMED BY: (EPA/State)	4. DESCRIPTION
Hydrogeologic study	continuing	company	One report complete; further study being conducted.
Recovery by pumping well	continuing	company	

NOTE: Based on the information in Sections III through X, fill out the Preliminary Assessment (Section II) information on the first page of this form.

V. Field Trip Summary Report

Field Trip Summary Report

A site visit was not conducted at this time due to the extent of work performed previously.

VI. Maps and Drawings

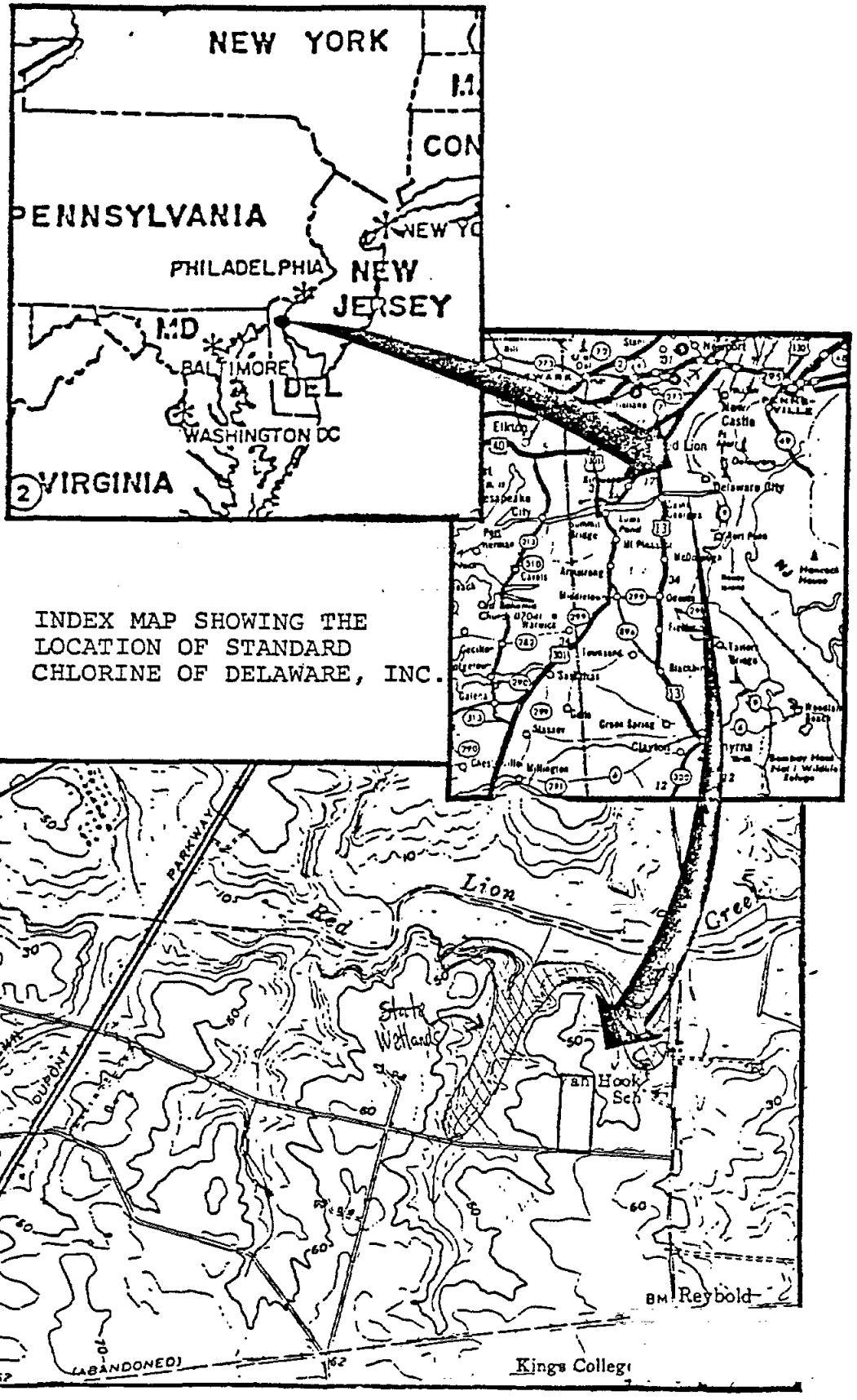


Figure 1: INDEX MAP SHOWING THE LOCATION OF STANDARD CHLORINE OF DELAWARE, INC.

VII. Photographs

11 STANDARD CHLORINE
CLEANING UP SPILL

Site Name : STD. CHLORINE
MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. MOTWANI
Signature

Film:

Lens:

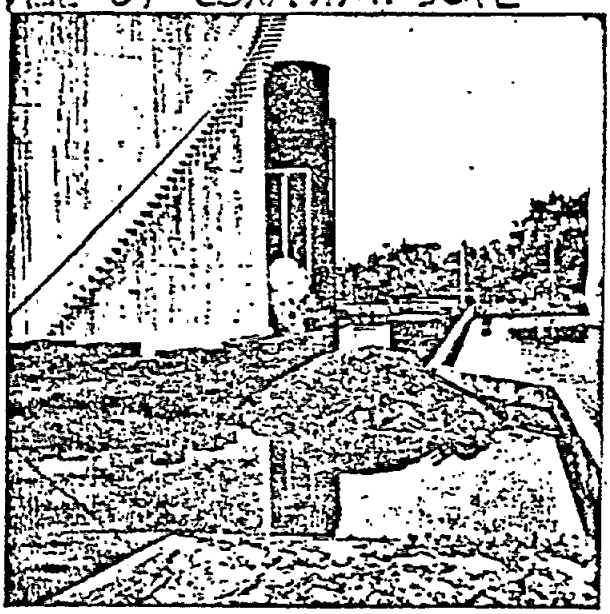
Camera:

Site Location: DE CITY, DE

Direction faced: S

Comment:

PILE OF ~~CONTAM~~. SOIL



12 STANDARD CHLORINE
CONTAINMENT AREA

Site Name : STD. CHLORINE
MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. MOTWANI
Signature

Film:

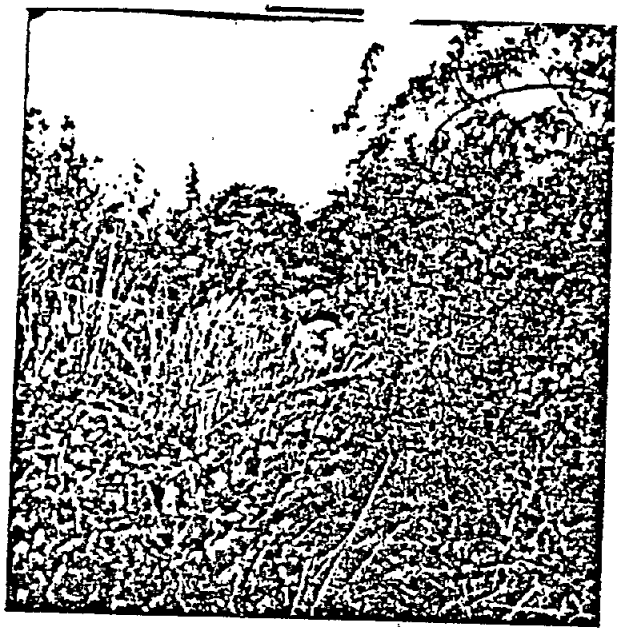
Lens:

Camera:

Site Location: DE CITY, DE

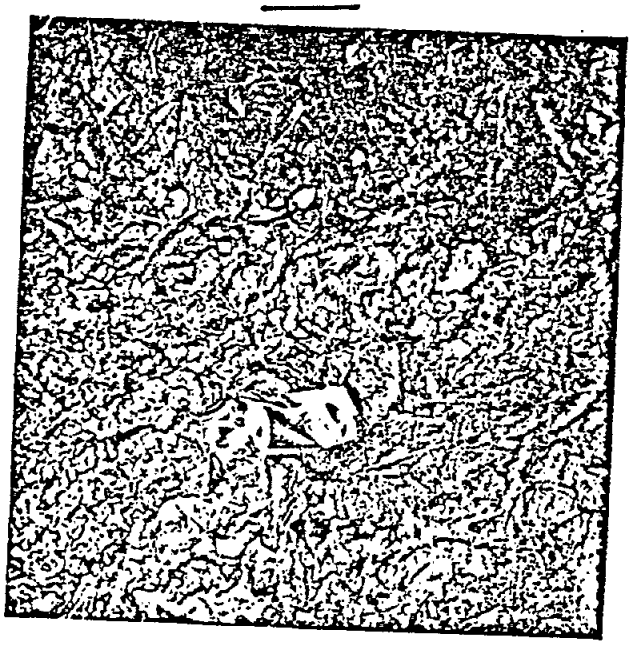
Direction faced: N

Comment: CONTAM
SOIL



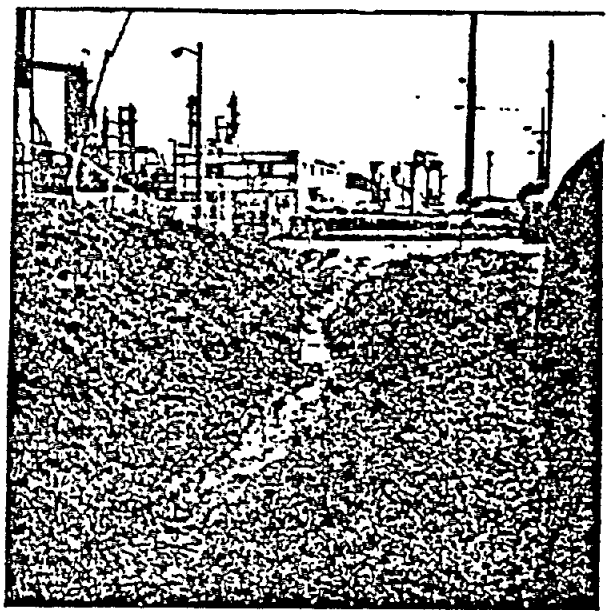
9 STANDARD CHLORINE
RT. OF SPILL

Site Name: STD. CHLORINE MCB SPILL 9-16-81
ID No.:
Date: 9-18-81
Time:
Photographer: J.N. MOTWANI
Signature
Film:
Lens:
Camera:
Site Location: DE CITY, DE
Direction faced: W
Comment: FOLLOWING SPILL RT.



10 STANDARD CHLORINE
MCB ON EDGE OF STREAM

Site Name: STD. CHLORINE MCB SPILL 9-16-81
ID No.:
Date: 9-18-81
Time:
Photographer: J.N. MOTWANI
Signature
Film:
Lens:
Camera:
Site Location: DE CITY, DE
Direction faced:
Comment: MCB Pepsi CAB 100084



7 STANDARD CHLORINE RT. OF SPILL

Site Name: STD. CHLORINE MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J. N. MOTWANI
Signature

Film:

Lens:

Camera:

Site Location: DE CITY, DE

Direction faced: E

Comment: SPILL FLOWED W

8 STANDARD CHLORINE DAM ON RT. OF SPILL

Site Name: STD. CHLORINE MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J. N. MOTWANI
Signature

Film:

Lens:

Camera:

Site Location: DE CITY, DE

Direction faced: E

Comment: SPIL

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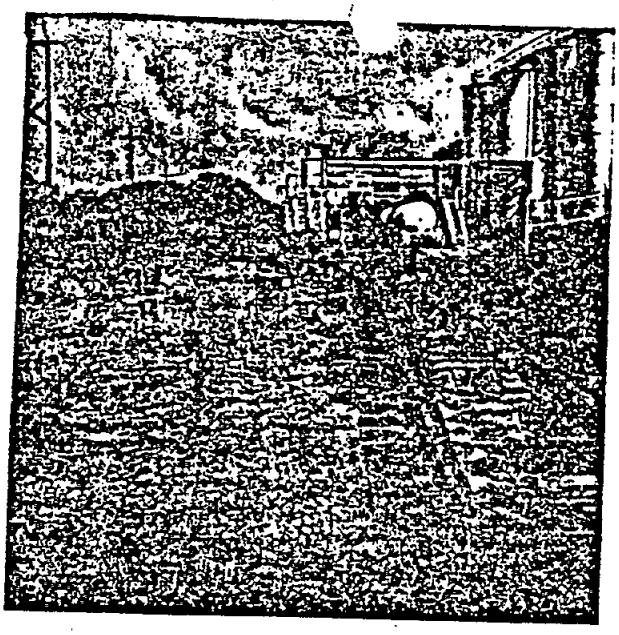


5 STANDALD CHLORINE
RT. OF SPILL

Site Name : STD. CHLORINE
MCB SPILL 9-16-81

ID No.:

Date:

Time: 9-18-81

Photographer: J.N. MOTWANI
Signature

Film:

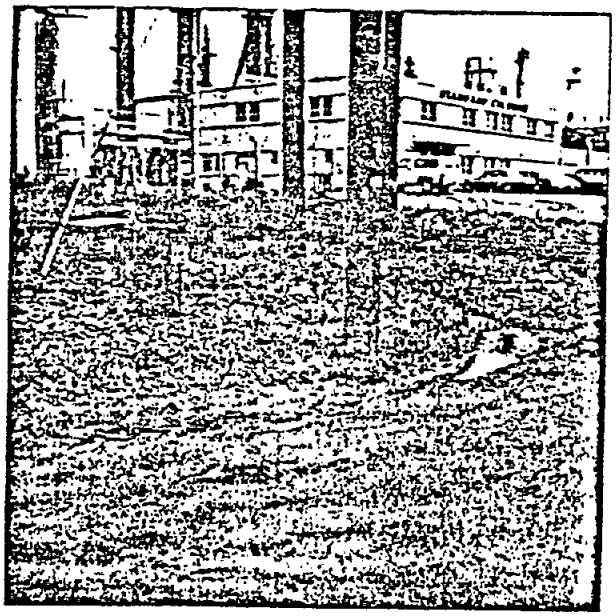
Lens:

Camera:

Site Location: DE CITY, DE

Direction faced: N

Comment: SPILL FLOWED S



6 STANDARD CHLORINE
RT. OF SPILL

Site Name : STD. CHLORINE
MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. MOTWANI
Signature

Film:

Lens:

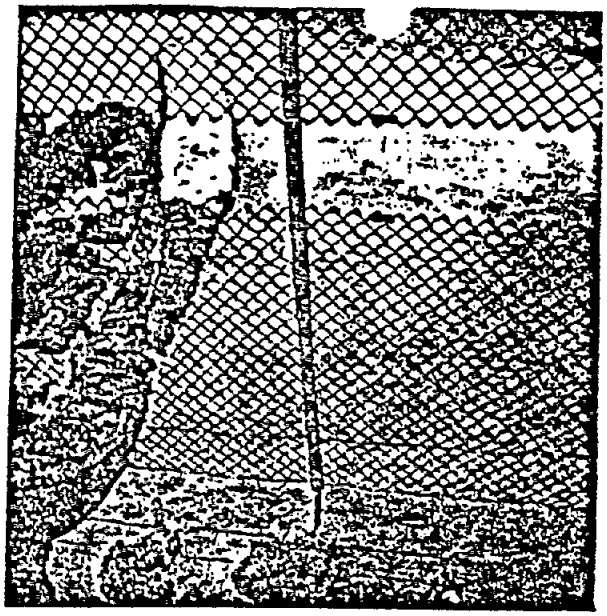
Camera:

Site Location: DE CITY, DE

Direction faced: NE

Comment: SPILL

AR100086



3 STANDARD CHLORINE MCB SPILL

STD. CHLORINE MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. MOTWANI
Signature

Film:

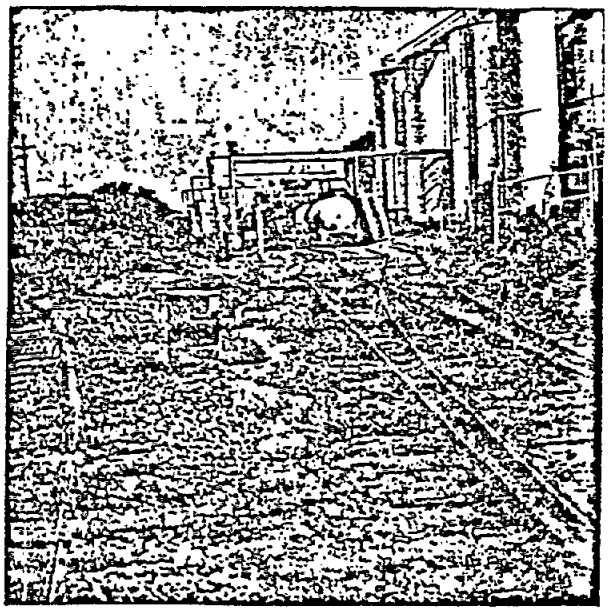
Lens:

Camera:

Site Location: DE CITY, DE

Direction faced: E

Comment:



4 STANDARD CHLORINE RT. OF SPILL.

Site Name: STD. CHLORINE MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. MOTWANI
Signature

Film:

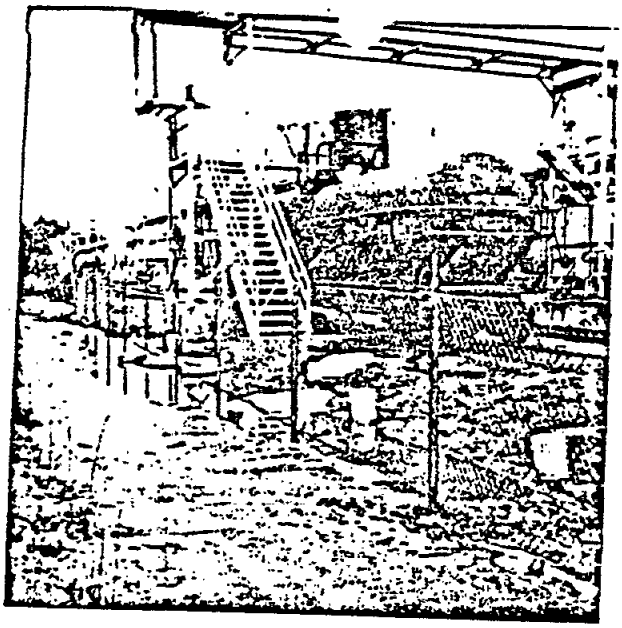
Lens:

Camera:

Site Location: DE CITY, DE

Direction faced: N

Comment: SPILL FLAMING S



1 STANDARD CHLORINE TANK CAR THAT OVERFLOWED

Site Name: STD. CHLORINE MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. Motwani
Signature

Film:

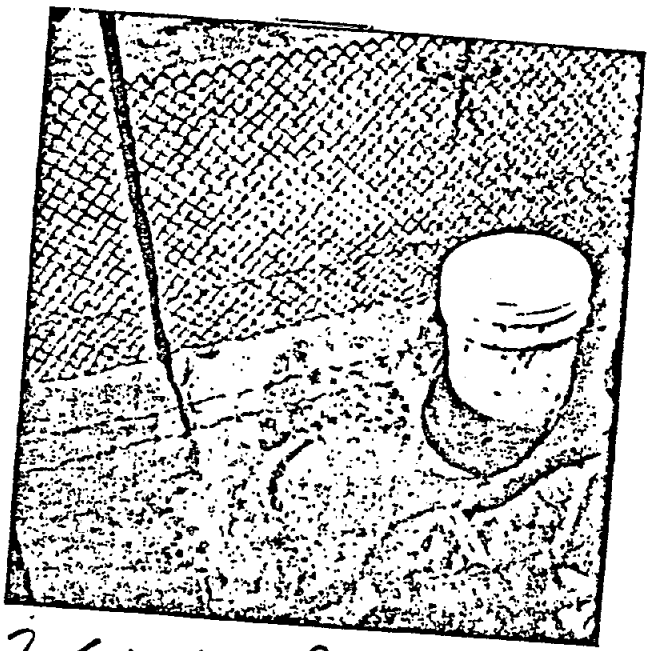
Lens:

Camera:

Site Location: DE City, DE

Direction faced: N

Comment:



2. STANDARD CHLORINE SPILL MONOCHLOROBENZENE

Site Name: STD. CHLORINE MCB SPILL 9-16-81

ID No.:

Date: 9-18-81

Time:

Photographer: J.N. Motwani
Signature

Film:

Lens:

Camera:

Site Location: DE City, DE

Direction faced: SE

Comment:

VIII. References

References

1. Soil Boring Data, Water Supply files, DNREC.

2. 10/22/81 letter from Standard Chlorine to DNREC; Hazardous Waste files.

3. Red Lion Creek water quality analysis: Water Supply files, DNREC.

4. Groundwater Quality, Water Supply files, DNREC. Mark Boller, field sampler for Water Supply, stated that groundwater samples have floating pieces of MCB which is not included in the analysis - if the sample was homogenized, the MCB concentration in the groundwater would probably be in the per cent range.

5. EPA Biodegradability Study (1980), in the Federal Register (11/28/80), Water Supply files, DNREC.

6. "Transport and Fate of Selected Organic Pollutants in a Sandy Soil", Water Supply files, DNREC.

7. "The Availability of Groundwater in New Castle County, Delaware", University of Delaware Water Resources Center (1971).

8. New Castle County, Delaware Soil Survey, U.S. Dept. of Agriculture (1970).

9. 1980 Census.

10. Air photos, Water Supply, DNREC (on wall)

11. Telecon: Bill Tansey, Operator of Getty Oil Company wells, Delaware City Delaware (12/15/83).

12. Telecon: Wilmington Suburban Water Company (12/5/83).

13. Air photos: Wetlands Branch, DNREC (12/15/83)

14. Memo from F. Moorshead (5/10/74), Water Supply files, Standard Chlorine - history, DNREC.

15. DNREC - Standard Chlorine PA/SI, Section V., p.2.

16. DNREC - Standard Chlorine PA/SI, Section III, p.1.

17. DNREC - Standard Chlorine PA/SI, Section II, p. 10.

18. Water Pollution files (DNREC), Red Lion Creek sample (5/31/830.

19. Conversation: Marilyn Plitnik, Geohydrologist, DNREC (1/9/84).

20. M. Apgar, Water Supply Branch, DNREC.